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Monitoring Micro-Structural Evolution and Crack Formation in a Solid Propellant under Incremental Strain Condition- Using Digital Radiograph X- Ray Techniques



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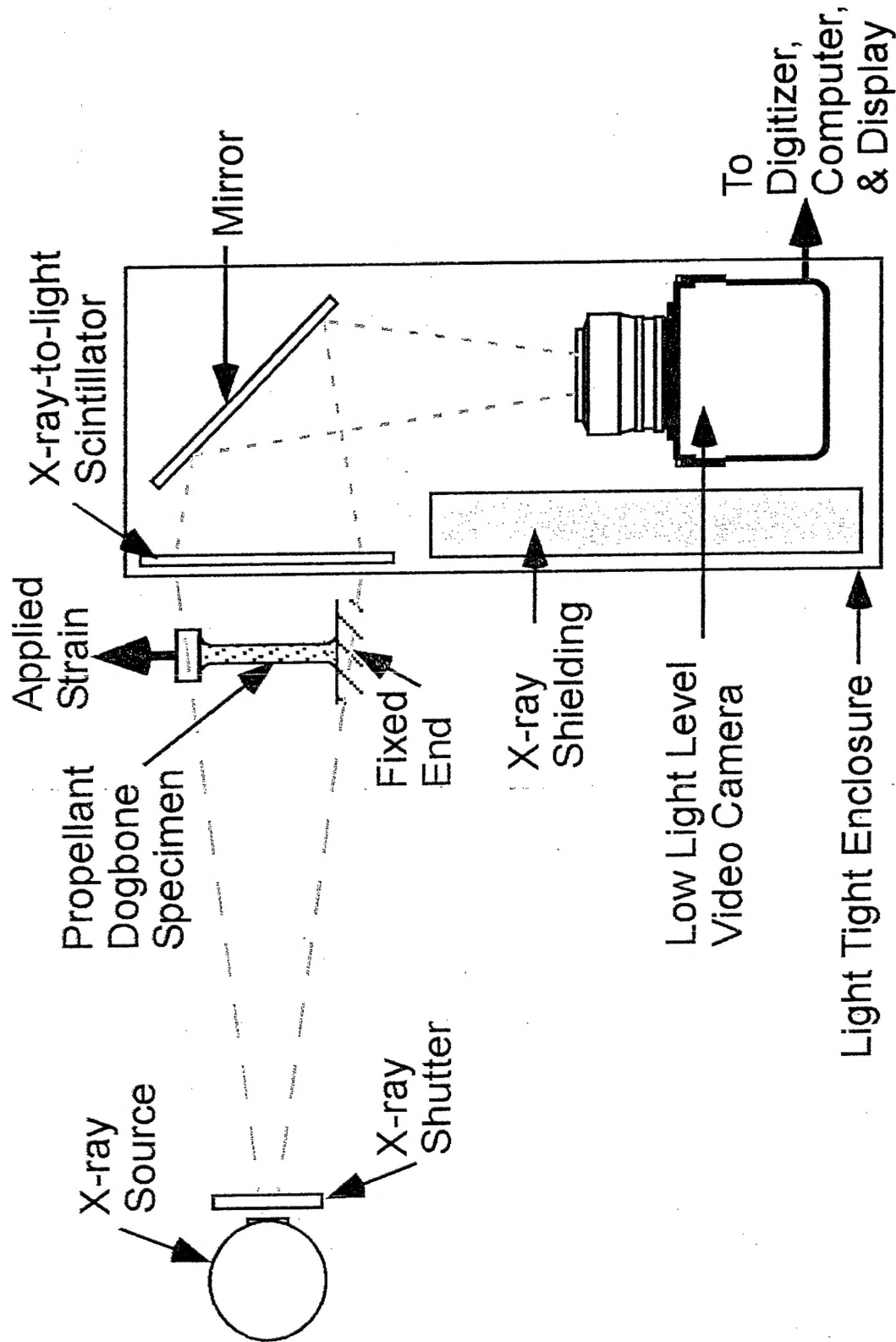


Objective

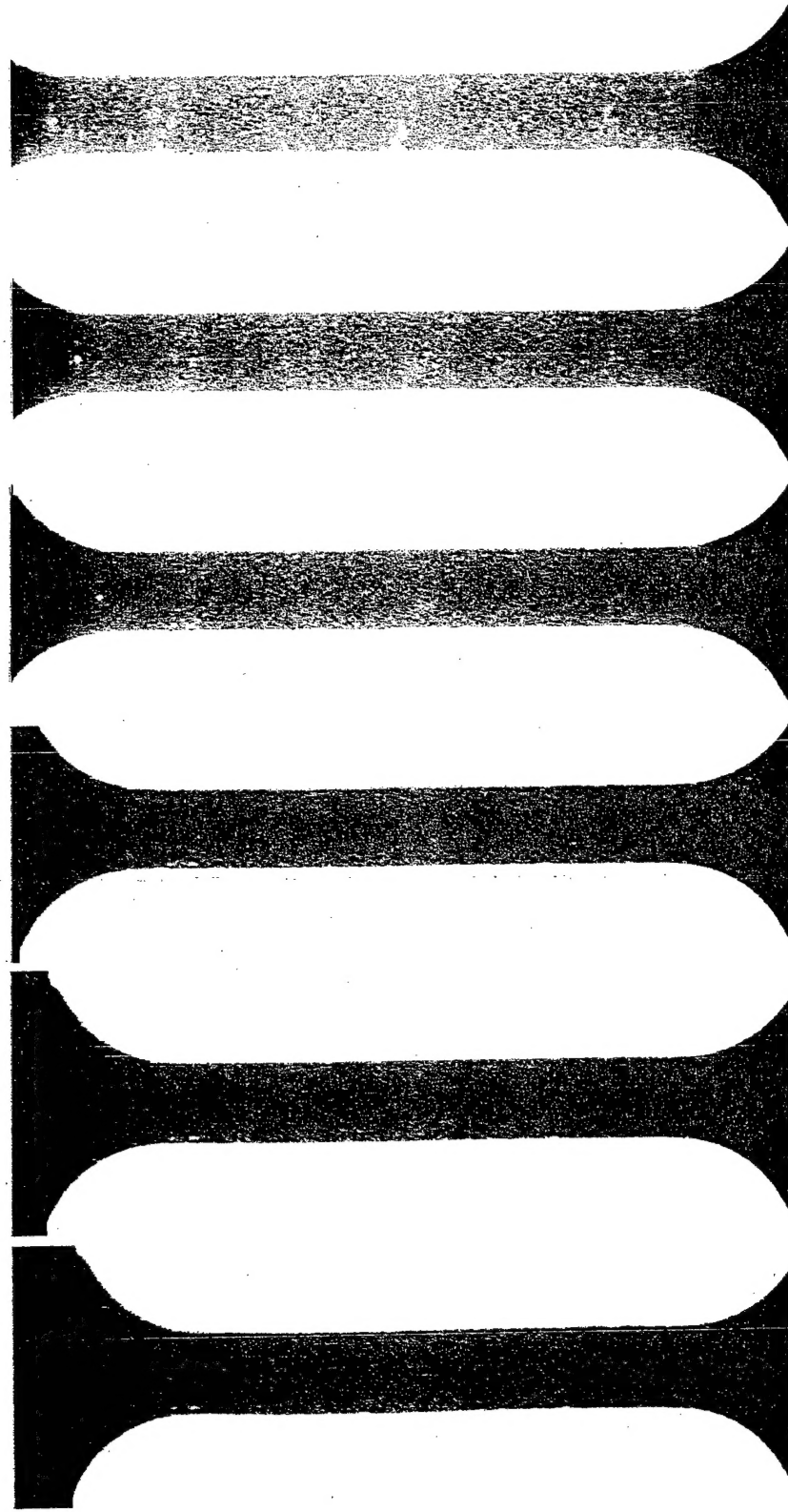


- Monitor Micro-Structure Evolution, Damage process, and Crack Formation in a Solid Propellant.

Testing Setup



X-Ray Images at Different Amounts of Stretch



0.0" stretch

0.1" stretch

0.2" stretch

0.3" stretch

0.4" stretch

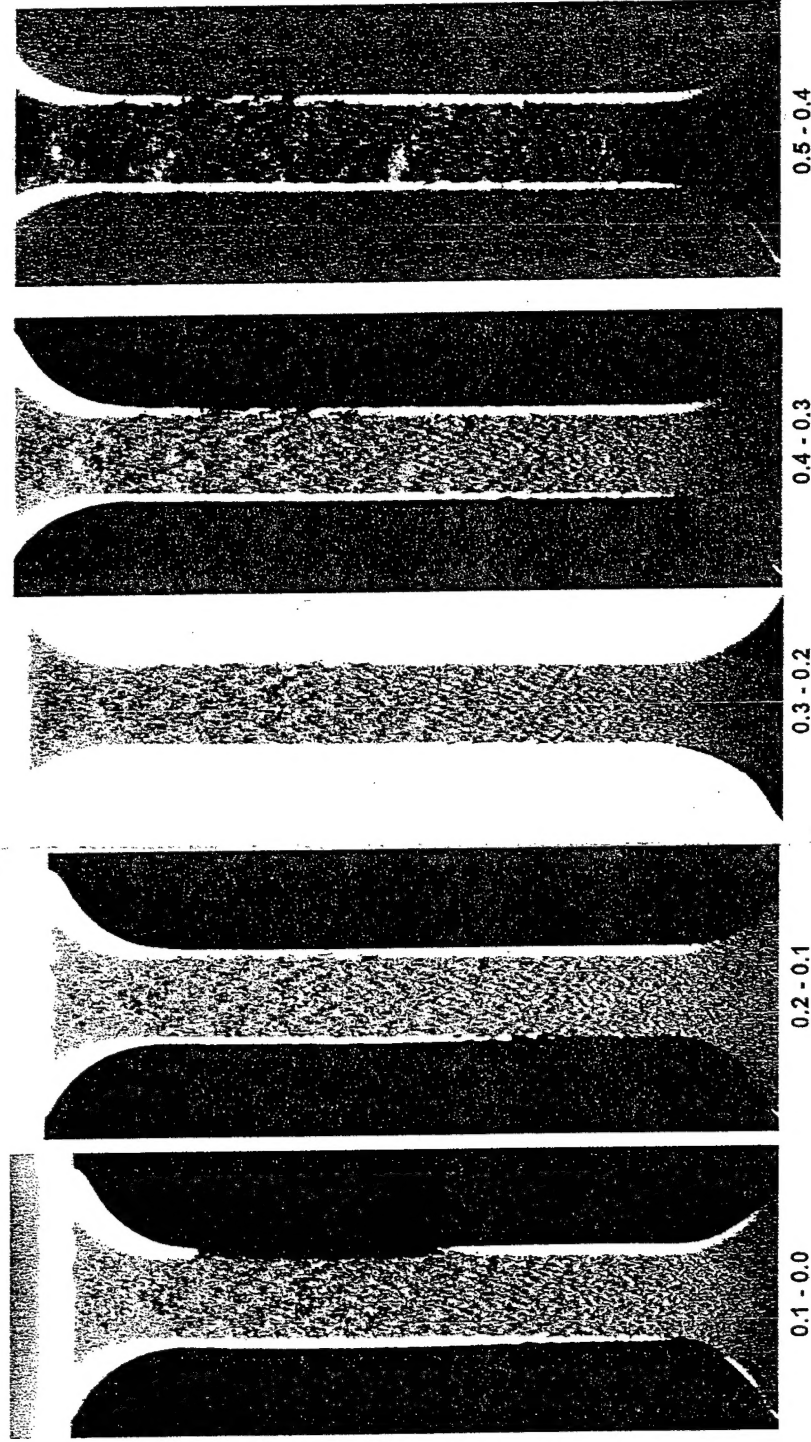
0.5" stretch

Unlabeled_Example3_comp.jpg

Test Sample #3

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Difference X-Ray Images of the Change from One Stretch to the Next



#sample3_diff_comp.jpg

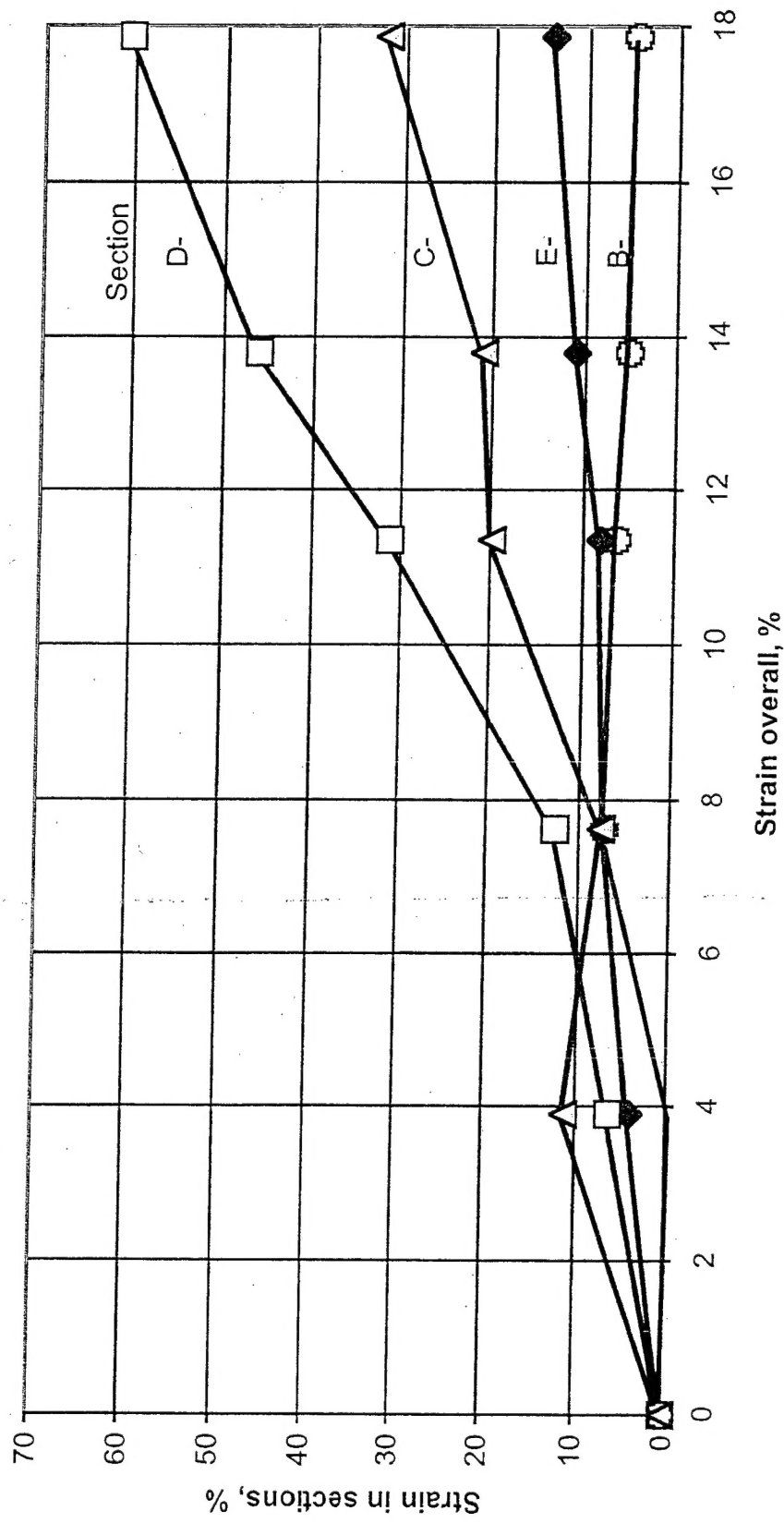
Difference Images for Sample #3



Section Strain as a Function of Applied Strain



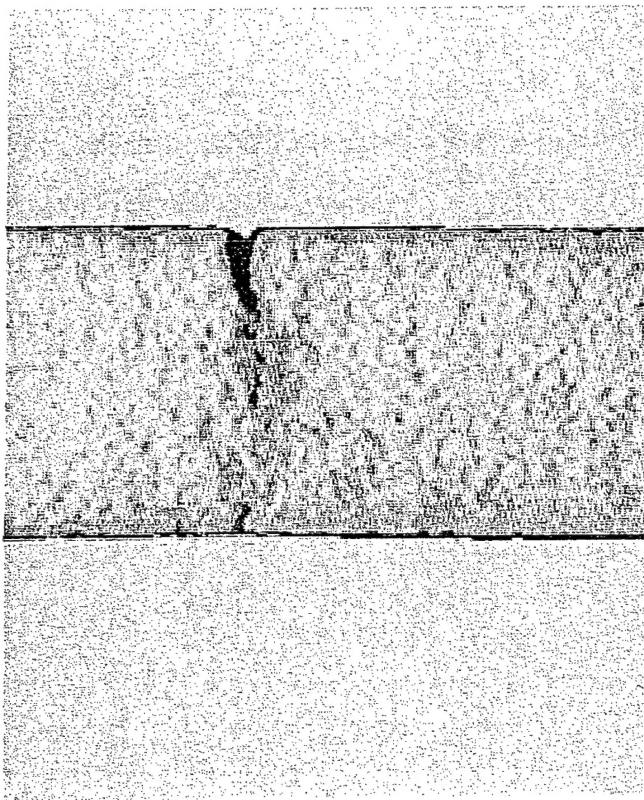
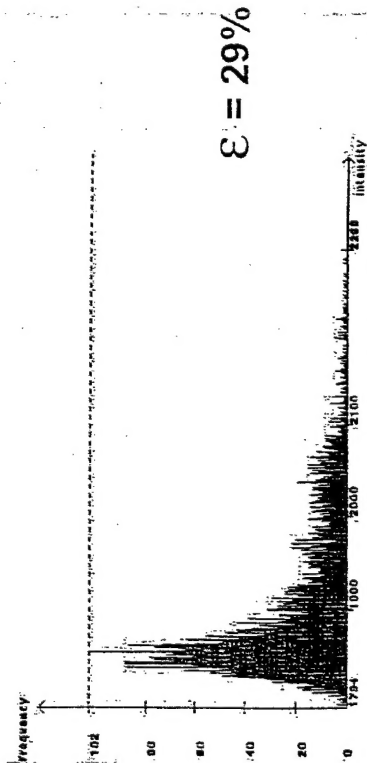
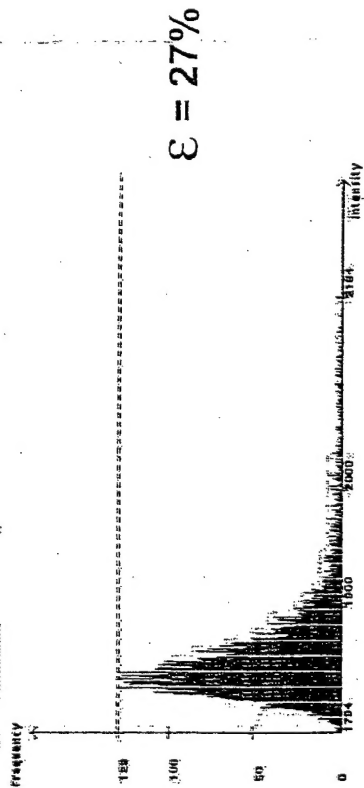
Strain plot for Uniaxial Tensile Test #3



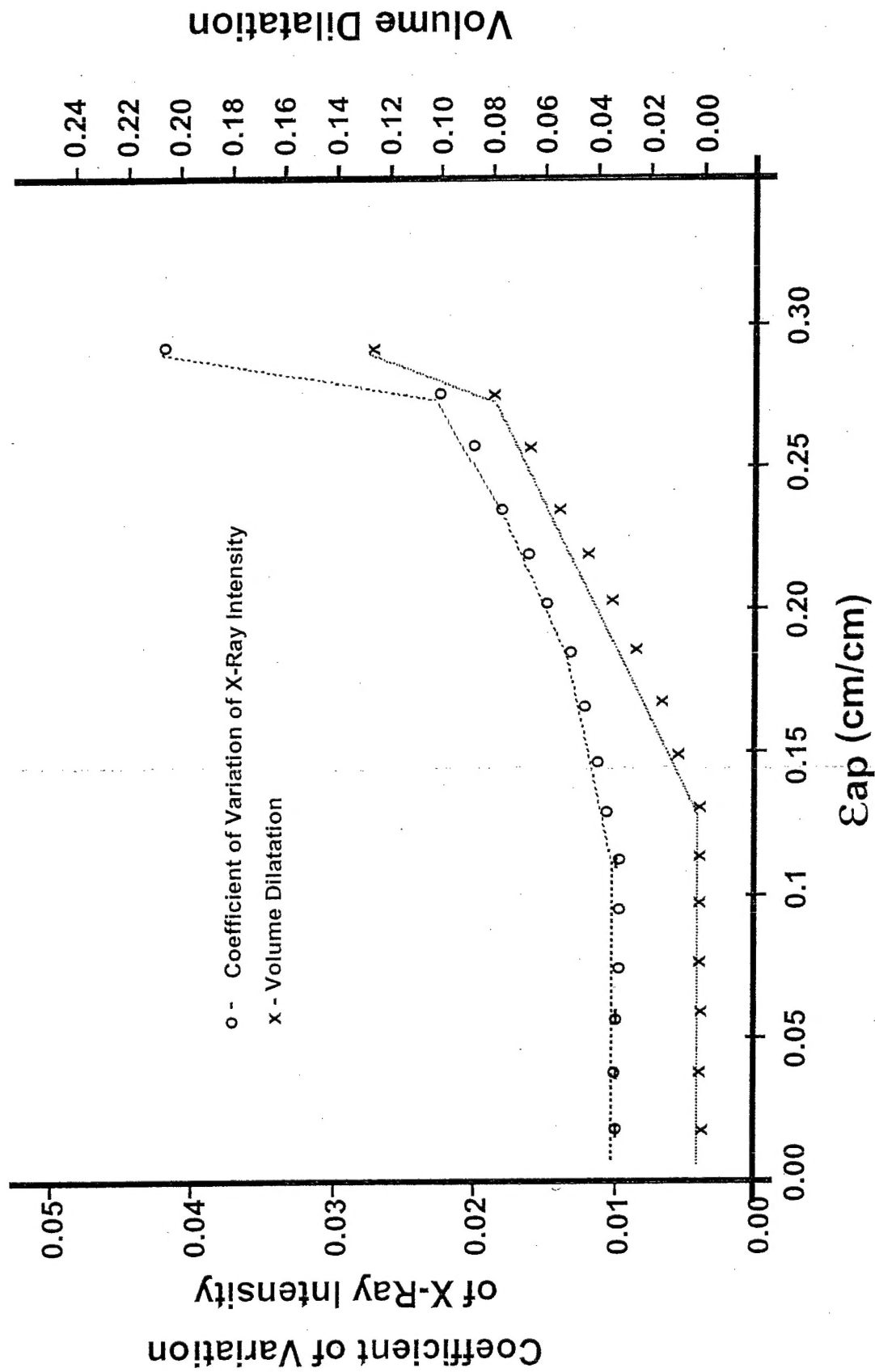


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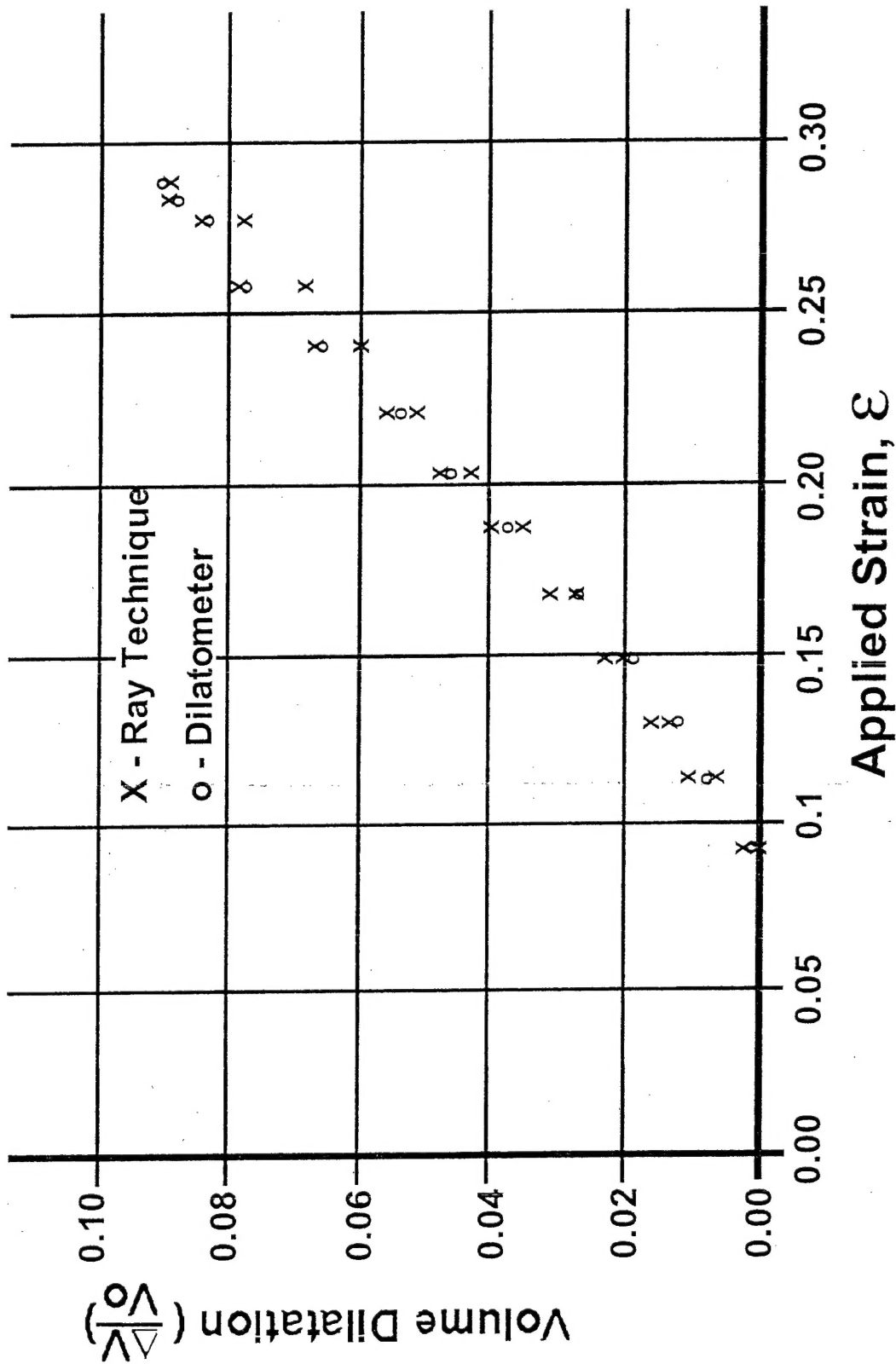
Histogram of X-Ray Intensity as Function of the Applied Strain at the Crack Location



Coefficient of Variation of X-Ray Intensity and Volume Dilatation as Functions of Applied Strain



Volume Dilatation as a Function of Applied Strain





Conclusions

- The degree of inhomogeneity of material's micro-structure and number of non-propagating cracks increase as the applied strain is increased.
- The rate of x-ray intensity increases very fast prior to the formation of a crack.
- At high applied strain levels, the strain distributions are highly non-uniform.
- A good correlation exists between the dilatations measured by x-ray technique and dilatometer.
- X-ray technique is a promising method to monitor micro-structure change and crack formation in solid propellants.

